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(54) COILING LINE FOR ROLLED STOCK

WICKELANLAGE FÜR WALZGUT

LIGNE DE BOBINAGE POUR MATERIAU LAMINE

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(56) References cited:
EP-A- 0 444 311
DE-A- 3 404 893
DE-A- 4 035 193
US-A- 3 796 389
US-A- 3 985 313
US-A- 4 664 329

- **PATENT ABSTRACTS OF JAPAN vol. 009, no. 172 (M-397), 17 July 1985 (1985-07-17) & JP 60 044471 A (HITACHI DENSEN KK), 9 March 1985 (1985-03-09)**

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Description

FIELD OF APPLICATION

[0001] This invention concerns a coiling line for rolled stock, particularly bars, plate, or rods (smooth or ribbed) of hot-rolled metal material, with a cross-section either round, square, rectangular, hexagonal or otherwise.

[0002] To be more exact, the invention concerns a coiling line located downstream of a traditional rolling train, equipped with drawing rollers and shears, wherein the rolled stock is wound into spirals to form coils which are subsequently tied to be stored or moved.

BACKGROUND OF THE INVENTION

[0003] Coiling lines which are known to the state of the art are substantially divided into two categories, according to whether the relative coiling machine has its axis of rotation vertical or horizontal.

[0004] Coiling machines with a vertical axis of rotation are based mainly on coiling inside containing cylinders, where the spirals are formed with the help of spiral-forming tools equipped with relative motion with respect to the containing cylinder.

[0005] This type of coiling machine generally does not ensure that a compact coil is formed, since the reciprocal movement of the spiral-forming tool and the containing cylinder is quite uncontrolled and since the stock which is being coiled is not subjected to a controlled tension.

[0006] Coiling machines with a horizontal axis of rotation normally allow to obtain much more compact coils, since the product to be coiled is wound on a central reel or mandrel, which is made to rotate by a motor organ. In such coiling machines, the coil is made by means of successive, superimposed rings or layers, which are coaxial to the reel, and thus compact coils are obtained.

[0007] The state of the art includes a coiling line associated with a rolling train wherein the rolled stock is coiled in a coiling machine with a horizontal axis and wherein, at the end of the line, there is a single assembly to collect and transport the already-formed coils arriving from the said line or from another coiling line.

[0008] This coiling line has the disadvantage that it does not guarantee a compact coil and that it has a relatively low productivity, since the time to remove, tie and move the already-formed coil must be added to the time needed to form the coil.

[0009] The state of the art also includes a rolling plant for the continuous production of iron bars, wire or round pieces, wherein a single plane product, obtained during a first rolling step, is divided into a plurality of profiles which are given the desired shape in subsequent rolling operations. In this plant the rolled products thus obtained travel parallel to each other towards stationary winding assemblies with a horizontal axis of rotation, which provide to coil them simultaneously, or in parallel, so as to form a plurality of coils on the same reel or mandrel.

[0010] This plant has the disadvantage that several profiles, which may even be different from each other, are wound onto the same winding or coiling assembly, and therefore each coil formed is neither compact nor in the least controlled while it is being formed.

[0011] Moreover, coiling lines which are known to the state of the art do not guarantee a uniform temperature over the whole stock which has been rolled and coiled, with differences at the leading and trailing end and the centre; this gives a lack of uniformity of the metallurgical aspect over the whole coil of rolled stock.

[0012] Document US-A-3,985,313 discloses an apparatus in which a single rotatable housing has two circumferentially spaced mandrels extending therefrom, parallel to the central axis thereof. A gear is provided in the housing for each mandrel and each mandrel can be clutched to the housing or to the respective gear. A first motor drives a central gear meshing with the two mentioned gears, while a second motor is provided for causing the rotation of the housing with respect to a stationary frame. The arrangement permits each mandrel to be positioned selectively in a reeling up position for winding up a reel, while the other mandrel is positioned in a discharging position for discharging a reel previously wound up thereon. The apparatus comprises also a lifting carriage movable on rails in a direction parallel to the axle of mandrel for pulling off the finish wound from the same winding mandrel. This is a well known apparatus of the so called carousel type, which is able to simultaneously position each mandrel in two different positions in such a manner that while one mandrel is in the reeling up position, the other mandrel is in the discharging position.

[0013] Document US-A-3,796,389 discloses an apparatus for winding one strip of thin band plate arranged in a slitting line, which comprises a vertical shaft rotatably mounted on a fixed support, a pair of driven shafts horizontally supported on opposite sides of the vertical shaft in symmetric relation with respect thereto. The driven shafts are associated to two corresponding winding mandrels. Motor means are provided to selectively rotating one of the paired driven shafts. When one of the driven shaft is in the winding position, connected via clutch means to the motor means, the other driven shaft is in the transfer position wherein the already formed coils are transferred onto a table. Also this apparatus is able to simultaneously position each driven shaft and the associated winding mandrel in two different positions in such a manner that while one mandrel is in the winding position, the other mandrel is in the discharging or transfer position.

[0014] Document DE-A-40 35 193, which forms the basis for the preamble of claim 1, discloses an apparatus to wind in at least two different winders the rolled material coming from a rolling mill, wherein the rolled material, before its winding, is firstly switched and then

caused to form a horizontal loop by a looper. The draw tension applied by the winding action is compensated at preceding assemblies. A braking/feeding system with peripheral contact on the rolled material is provided to support the catch process at each winder and is set to a forward rotary motion in a drive action and, when the rolled material is caught, it is switched to a braking mode where the nominal rotary speed is reduced in relation to the travel speed of the rolled material. The current for the advance drive and the preset speed level acts as a guide drive matching the winder rotary speed. The position of each loop is controlled by variations in the corresponding winder rotary speed. The loop control starts when the rolled material has been caught and ceases when the end of the rolled material has passed through the looper. After the rolled material has emerged, the rotary speed of the looper drive is shifted to a nominal value, and then switched back after intermediate braking to direct the low speed material into the winder and then finally stopped. This is a very complicated and complex system to control the speed of the rolled material and the loop formed before and during its winding on a plurality of winders.

[0015] The present applicant has designed, tested and embodied this invention to overcome the shortcomings of the state of the art and to obtain further advantages.

SUMMARY OF THE INVENTION

[0016] The coiling line according to this invention is set forth and characterised in the main claim, while the dependent claims describe other characteristics of the main embodiment.

[0017] The main purpose of the invention is to achieve a coiling line which will allow to continuously coil the rolled stock emerging from a rolling train, without any dead times or waiting times, so that the line has a very high productivity.

[0018] In accordance with this purpose, the coiling line according to the invention, which is located downstream of a rolling train provided with shears suitable to selectively shear the rolled stock, comprises downstream of the shears a first coiling machine suitable to coil the rolled stock so as to achieve a corresponding first coil, a second coiling machine suitable to coil the rolled stock so as to achieve a corresponding second coil and selection means to take the rolled stock to wind alternatively either onto the first or onto the second coiling machine.

[0019] To be more exact, in accordance with a first form of embodiment, the coiling line according to the invention comprises a switching device, located downstream of the shears, to switch the rolled stock alternatively either to the first coiling machine or to the second coiling machine.

[0020] In accordance with a second form of embodiment, the coiling line according to the invention comprises a rotary support on which the coiling machines are mounted, rotation means to rotate the support and selectively take one of the coiling machines in correspondence with a device to distribute the spirals and simultaneously another of the coiling machines in correspondence with a coil-handling assembly suitable to remove the coil of rolled stock from the corresponding coiling machine.

[0021] In accordance with a third form of embodiment, the coiling line according to the invention comprises a rotary element on which each coiling machine is mounted rotatable, motor means to make said element rotate and selectively take each of the coiling machines either in correspondence with a device to distribute the spirals or in correspondence with a coil-handling assembly suitable to remove the coil of rolled stock from the corresponding coiling machine. In this third form of embodiment, a pair of coiling machines is associated with the same coil-handling assembly, so that while one coiling machine of the pair is winding the rolled stock, the other coiling machine coupled thereto is discharging the already-coiled coil onto the coil-handling assembly.

[0022] In this way, irrespective of the form of embodiment, while one coil is removed from one coiling machine and sent for weighing and storing, at least a second coil is forming on another coiling machine.

[0023] It is thus possible to coil rolled stock travelling at speeds of more than 40 metres per second, with an hourly production in the order of 100-110 tonnes per hour.

[0024] A second purpose of the invention is to achieve a coiling line wherein upstream of each coiling machine there is a device which keeps the rolled stock under tension and controls the resistant traction of each rolled product while it is being coiled.

[0025] A third purpose of the invention is to achieve a coiling line wherein upstream of each coiling machine there is a device which guides the formation of the spirals of the coil, both lengthwise so as to form rings of spirals with a predetermined packing, and also in a transverse direction, that is to say, ring after ring or layer after layer.

[0026] Another purpose of the invention is to achieve a coiling line wherein, for each coiling machine, means are provided to maintain the coil uniformly compact, so as to guarantee uniformity of temperature and of metallurgical features over the whole rolled and coiled stock, without appreciable differences between the leading end, the centre, and the trailing end thereof.

[0027] A further purpose of the invention is to achieve a coiling line wherein, for each coiling machine, there are means to remove the formed coil without unravelling the spirals and ruining the outer layers, and wherein there are means to transport each coil quickly and safely, each coil being able to reach a weight in the order of 3.5 tonnes, towards a tying station first and a weighing and storing station later.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] These and other characteristics of the invention will become clear from the following description of a preferred form of embodiment, given as a non-restrictive example, wherein:

Fig. 1 is a view from above, in diagram form, of a coiling line according to the invention in accordance with a first form of embodiment;
Fig. 2 is a view from above, enlarged, of the coiling line shown in Fig. 1;
Fig. 3 is a view from above, in diagram form, of a variant of a coiling line as shown in Fig. 1;
Fig. 4 is a view from above of an enlarged detail of the coiling lines according to the invention;
Fig. 5 is a view along a line from A to A of Fig. 4;
Fig. 6 is a view along a line from B to B of Fig. 4, with the coiling line according to the invention in a first working position;
Fig. 7 is a view of Fig. 6, with the coiling line according to the invention in a second working position;
Fig. 8 is a view from above, in diagram form, of a coiling line according to the invention in accordance with a second form of embodiment;
Fig. 9 is a view from above, in diagram form, of a coiling line according to the invention in accordance with a third form of embodiment; and
Fig. 10 is a view from above, in diagram form, of a variant of the coiling line shown in Fig. 9.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0029] With reference to Fig. 1, a coiling line 10 according to the invention is suitable to be arranged downstream of a rolling train 11 for hot rolled stock 12, such as bars, plate, or rods (smooth or ribbed) of metal material, with a cross-section either round, square, rectangular, hexagonal or otherwise.

[0030] The rolling train 11 can be of any known type, for example of the type described in the application for a patent of industrial invention n°. UD97A000105 which this Applicant filed on 5 June 1997, and comprising drawing rollers 13, conveying channels 14 and a series of four stages of controlled water cooling 15 (water boxes), suitable to remove heat and to cool the rolled stock 12, arresting their tempering, before the coiling step.

[0031] Downstream from the last water cooling stage 15 there is a shears 16 suitable to shear to size the rolled stock 12 to be coiled, and to crop the leading and trailing end, and also to possibly perform the emergency scrapping of the rolled stock 12 if necessary.

[0032] The coiling line 10 according to the invention is suitable to coil rolled stock with diameters of between 8 and 52 mm or, in the case of bars or plate, with a section of between 60 mm^2 (for example 20 mm by 3 mm) and 1400 mm^2 (for example 70 mm by 20 mm).

[0033] The coiling line 10 comprises a switching device 17, of the hydraulic type, arranged at the outlet of the shears 16 and suitable to selectively and alternatively switch the individual rolled product 12 either to a first coiling machine 21 or to a second coiling machine 22.

[0034] According to a variant, shown in Fig. 3, the switching device 17 is able to switch the rolled stock 12 also to a third and a fourth coiling machine 121 and respectively 122.

[0035] This embodiment can be used in the event that two products emerge from the rolling train 11 obtained by splitting a single original product.

[0036] In this case, there is a real doubling of the coiling line, especially in terms of productivity.

[0037] Between the switching device 17 and each of the coiling machines 21, 22, 121 and 122 there is a loop forming assembly 23 (looper), of a known type, suitable to regulate the flow of rolled stock 12 towards the coiling machine 21, 22, 121 and 122 and to make it correctly perform the increase in diameter step, during the same coiling operation. The looper 23 thus fulfils a function of a buffer for the rolled stock 12 before it is coiled.

[0038] Between each looper 23 and each coiling machine 21, 22, 121 and 122 there is a device to distribute spirals 25 (Figs. 2, 4 and 5) comprising a tubular guide 26, about 5.5 meters long and with one end 27 pivoting on the base and one end 28 mounted on a distribution trolley 29 movable horizontally, under the command of a low inertia electric motor 30 and an appropriate connection by a screw/nut screw, not shown in the drawings.

[0039] The end 28 of the guide 26 is also movable vertically on the trolley 29 so that it can pass from one ring of spirals to the following one with a larger diameter and thus perform the increase in diameter step within the same coiling cycle. A balancing device 34 of a pneumatic type is connected to the end 28 of the guide 26 to facilitate the increase in diameter step and the variation thereof during coiling.

[0040] Each coiling machine 21, 22, 121 and 122 is of the precision type, that is to say, of the type in which the individual spirals are formed under the guidance of mechanical means which regulate their packing, their density, and their tension. To be more exact, each coiling machine 21, 22, 121 and 122 comprises a reel or mandrel 31 with a horizontal axis of rotation, mounted cantilevered, rotatable on a stationary structure 32 and commanded by an electric motor 33.

[0041] A cylindrical plate 35 is suitable to cooperate with the mandrel 31 and pivots on a shaft 36 so as to be able to move from a working position, wherein it is arranged substantially orthogonal to the axis of rotation of the mandrel 31 and cooperating therewith, to an inactive position, shown in Fig. 5, wherein it is distanced and lowered with respect to the mandrel 31 and arranged substantially horizontal.

[0042] The mandrel is formed by four expansion elements, radially movable so as to facilitate the removal of the just-formed coil. The radial movement of the four elements is obtained with a hydraulically commanded and water cooled mechanism 37.

[0043] Downstream of each coiling machine 21, 22, 121 and 122 there is a coil-handling assembly 40 (Figs. 6 and 7), which is suitable to remove the coil of just-formed rolled stock 12 and to position it on a coil-transport assembly 50 located downstream thereof.

[0044] The coil-handling assembly 40 comprises a trolley 41 movable horizontally on fixed rails, by means of a hydraulic command.

[0045] On a pin 42 of the trolley 41 a supporting frame 43 pivots, on which four idler rollers 45 are mounted rotatable and parallel to each other to contain the spirals of the coil, and also a fork-type device 46, suitable to remove and support the coils during a step when they are turned over through 90° to take them from the forming position, with a horizontal axis, to the moving position, with a vertical axis.

[0046] The supporting frame 43 and the fork-type device 46 are commanded hydraulically to perform the steps of gripping, removing, turning over and releasing each coil which has formed on the respective coiling machine 21, 22, 121 or 122.

[0047] The rollers 45 are also suitable to cooperate with the trailing end of the rolled stock 12 during the final step of coiling.

[0048] The coil-transport assembly 50 comprises a bench 51 movable vertically and commanded hydraulically. The bench 51 is provided with four movable grippers 52, also commanded hydraulically, which are suitable to grip the coil arranged by the handling assembly 40 with the axis in the vertical position, to prevent the spirals of the coil from unravelling.

[0049] The coil-transport assembly 50 also comprises a tying and strapping station 53, wherein the coils of rolled stock 12 are tied in known manner. The bench 51 is also able to rotate on itself through 90°, together with the coil which it is carrying, so that the tying station 53, although it has only two tying machines, one opposite the other, is able to perform at least four tying operations for each coil.

[0050] The coil-transport assembly 50 also comprises a chain transporter 55, provided with a weighing bascule 56 (Figs. 2 and 3) to weigh the coils.

[0051] The transporter 55 is suitable to discharge and store the coils formed on each of the coiling machines 21, 22, 121 and 122.

[0052] The coiling line 10 as described heretofore functions as follows:

[0053] The rolled stock 12 (Fig. 1) arriving from the rolling train 11 and possibly from the hardening line passes through the controlled cooling stages 15. The drawing rollers 13 ensure that the rolled stock 12 is kept under tension along the whole line of passage.

[0054] After the shears 16 has optionally cropped the leading end of the rolled stock 12, the switching device 17, according to one characteristic of the invention, alternatively directs the rolled stock 12 to one of the coiling machines 21, 22 and, in the event of two rolled products, 121 and 122 (Figs. 2 and 3), in such a way that at least one of the coiling machines is always in the coiling stage while the just-formed coil is being removed from the other coiling machine.

[0055] At this point we shall describe only how the coiling machine 21 functions, since all the others function in the same way.

[0056] The drawing rollers 13 of the looper 23 ensure that the rolled stock 12 is kept under tension and is coiled onto the mandrel 31 of the coiling machine 21 under traction. They also form the loop needed to accumulate rolled stock 12 to be supplied quickly to the coiling machine 21 during the increase in diameter step of one coil. The drawing rollers 13 brake the trailing end of the rolled stock 12, to keep it at the desired tension when the mandrel 31 decelerates and stops at the end of the coiling step.

[0057] The rolled stock 12 is then guided to the coiling machine 21 by the tubular guide 26. At first the guide 26 of the spiral distributor 25 is substantially arranged on the horizontal plane, displaced towards the inside of the mandrel 31. The first spirals are formed with the aid of spiral forming devices of a known type, after which the inner end 28 of the guide 26 is displaced horizontally, backwards and forwards, by the trolley 29 and upwards at the end of every ring of spirals, controlled by the balancing device 34. It is thus possible to obtain a rational and controlled distribution of the spirals both on every single ring and also on the different coaxial rings which form the coil.

[0058] With every ring of spirals the mandrel 31 is made to rotate by the motor 33 at a speed temporarily below that of the drawing rollers 13 of the looper 23. The rolled stock 12 is released by the looper 23 at the moment when one ring of spirals is completed and the subsequent ring is started. At this moment the peripheral coiling speed increases in ratio to the change of diameter and the motor 33 adapts its angular speed.

[0059] The speed of rotation of the reel or mandrel 31 is controlled by the loop formed by the looper 23, by means of a rotary probe and the motor 33 is torque controlled, and therefore guarantees at every moment the desired coiling traction, irrespective of the speed of the rolled stock 12.

[0060] Layer after layer, or ring after ring, the coil is formed until the rolled stock 12 has been completely coiled.

[0061] The shears 16 is commanded to shear to size the rolled stock 12 which is coiling on the coiling machine 21, in such a way that the dimensions and weight of the coil are predefined.

[0062] After the trailing end of the rolled stock 12, sheared by the shears 16, has passed beyond the switching device 17, the latter is activated to switch the

rolled stock 12 towards the second coiling machine 22.

[0063] In the meantime, the first coiling machine 21 completes coiling the rolled stock 12. In particular the motor 33 is rapidly decelerated, so that the mandrel 31 stops in a very short time.

[0064] During this deceleration step, when the speed of rotation is low and before the trailing end of the rolled stock 12 emerges from the rollers of the drawing assembly 13 located upstream of the spiral distributor 25, the cylindrical plate 36 is distanced from the mandrel 31 and the handling assembly 40 is taken towards the coiling machine 21, with its four idler rollers 45 coaxial to the coil which is just being completed.

[0065] The rollers 45 close on the rotating coil and thus prevent the last spirals of the coil from unravelling. In this way the rollers 45 also collaborate in the final step of coiling the trailing end of the compact coil.

[0066] When the motor 33 has completely stopped and the coil of rolled stock 12 is stationary, the forks of the support 43 are inserted between the coil and stationary plate to contain the spirals, orthogonal to the mandrel 31, to ensure that the coil is supported while it is removed and rotated by 90°.

[0067] The trolley 41 is then translated horizontally so that the coil is removed horizontally from the mandrel 31, which at the same time retracts radially, commanded by the mechanism 37.

[0068] The support 43 is then rotated by 90°, together with the coil which is attached thereto, in such a way as to take the coil itself above the bench 51 which is already prepared in a raised position.

[0069] The grippers 52 grip the coil of rolled stock 12 to prevent it from unravelling, the bench 51 is made to descend towards the tying and strapping station 53 where the coil is tied.

[0070] The chain transporter 55 then provides to transport the coil towards the weighing bascule 56 and subsequently to a storage zone where it may be moved further.

[0071] In accordance with a second form of embodiment, shown in Fig. 8, the two coiling machines 21 and 22, instead of being stationary as they are in the embodiment as described heretofore, are mounted on diametrically opposite sides of a support 117 rotating on a shaft 60 with a vertical axis of rotation.

[0072] In this embodiment the switching device 17 is not provided, because it is not necessary; however, the embodiment does provide a single channel to convey the rolled stock 12 downstream of the shears 16, a single device 25 to distribute spirals, a single looper 23 upstream of the spiral distributor 25, a single coil-handling assembly 40 and, consequently, a single coil-transport assembly 50.

[0073] To be more exact, the spiral distributor 25 and the assemblies 40 and 50 are positioned on opposite sides of the rotary support 117, so that while one of the coiling machines (for example the one indicated by the reference number 21) is in correspondence with the spiral distributor 25, the other coiling machine (for example, the one indicated by the reference number 22) is in correspondence and aligned with the coil-handling assembly 40 and the coil-transport assembly 50.

[0074] Drive means 61 are connected to the shaft 60 to selectively rotate by 180° the support 117 around its vertical axis and thus to execute the change in the angular position of the two coiling machines 21 and 22.

[0075] A device 62 including idler rollers is provided on each coiling machine 21 and 22 to prevent the just-formed coil from unravelling.

[0076] Synchronisation means, of a mechanical or electronic type, are provided to synchronise the various command organs of the coiling line.

[0077] The coiling line according to this form of embodiment functions as follows:

[0078] Initially the rolled stock 12 is coiled onto the coiling machine 21, in a manner identical to that described for the first embodiment.

[0079] When the coil is complete, the device 62 is actuated to prevent the spirals of the coil from unravelling, and the drive means 61 are actuated which make the support 117 quickly rotate by 180°, thus achieving the change in angular position of the two coiling machines 21 and 22.

[0080] The coiling machine 21 is thus taken in correspondence with the coil-handling assembly 40, which will provide to manage and move the coil which has just formed, in the manner we have already described.

[0081] At the same time, the coiling machine 22, which is empty, is taken opposite the spiral distributor 25, which will thus provide to form a coil of rolled stock 12.

[0082] While the support 117 is rotating, which it does very quickly, the looper 23 is actuated to slow down the rolled stock 12 and prevent the leading end thereof from coming into contact with the space occupied by the coiling machines which are rotating with the support 117.

[0083] In order to optimise the working times, the support 117 can even begin to rotate when the coil forming in the coiling machine 21 is not yet completely finished, but the trailing end of the rolled stock 12 has in any case passed beyond the drawing rollers 13.

[0084] Alternately, associated with each coiling machine 21 and 22, mounted on the support 117, the embodiment provides to mount a segment of guide channel, which can move transversely to the longitudinal axis of the mandrel of the coiling machine 21, in synchronisation with the movement of the end 28 of the spiral distributor 25, for example by means of crossed-pitch twin screws.

[0085] In accordance with a third form of embodiment of the invention, shown in Fig. 9, each of the four coiling machines 21, 22, 121 and 122 is associated with a single spiral distributor 25, exactly as provided in the variant shown in Fig. 3. Unlike that variant, however, in this third form of embodiment each pair of coiling machines 21, 22 and respectively 121, 122 is associated with a

single coil-handling assembly 40, with a coil-transport assembly associated 50.

[0086] To be more exact, each coiling machine 21, 22, 121 and 122 is mounted on its own rotating vertical pin 70, commanded by an electric motor of a known type and not shown in the drawings. Each coiling machine 21, 22, 121 and 122 is thus suitable to rotate on a horizontal plane between a first working or coiling position, wherein the relative reel 31 is arranged in correspondence with the spiral distributor 25 associated therewith, and a second working position, or coil discharge position, wherein the axis of rotation of the reel 31 is rotated by about 60° and aligned with the corresponding coil-handling assembly 40.

[0087] According to a variant of this third form of embodiment, shown in Fig. 10, each coiling machine 21, 22, 121 and 122 can be rotated by 90° around its own pin 70. In this case, in the second working position, each reel 31 has its own axis of rotation aligned with the coil-handling assembly 40. In its turn, the latter is mounted sliding on longitudinal 71 and transverse 72 guides to collect the coils formed on the corresponding reel 31 and to transfer them to the assembly 50.

[0088] It is obvious that modifications and additions may be made to the device to remove and move coils of rolled stock coiled by a corresponding coiling machine as described heretofore, without departing from the scope of the invention as defined by the appended claims.

Claims

1. A coiling line located downstream of a rolling train (11) provided with shears (16) suitable to shear the rolled stock (12) coming from the rolling train (11), comprising a first coiling machine (21) having a first rotatable mandrel (31) connected to a corresponding drive means (33) for winding the rolled stock (12) to realise a corresponding first coil, at least a second coiling machine (22) having a second rotatable mandrel (31) connected to a corresponding drive means (33) for winding the rolled stock (12) to realise a corresponding second coil, selection means (17, 117) disposed downstream of said shears (16) to deviate the rolled stock (12) alternatively towards said first or said at least second coiling machine (21, 22), **characterised in that** means are provided for actuating said drive means (33) one at a time, while all the other drive means (33) are maintained stopped, and **in that** each of said coiling machines (21, 22) comprises a corresponding coil-handling assembly (40) associated to the mandrel (31) to axially remove the already-completed coil from the mandrel (31) while the drive means (33) connected thereto are maintained stopped and for transferring said coil to coil-transport means (50) disposed downstream of said coil-handling assembly (40).

2. A coiling line as in claim 1, **characterised in that** said selection means (17, 117) are able to deviate the rolled stock (12) to coil selectively onto a third and a fourth coiling machine (121, 122), each of which is able to wind the rolled stock (12) to realise a corresponding third and fourth coil.

3. A coiling line as in claim 1 or 2, **characterised in that** said coiling machines (21, 22) are disposed in fixed positions with respect to said shears (16) and that said selection means comprise a switching device (17) arranged downstream of said shears (16) to selectively deviate the rolled stock (12) either to said first coiling machine (21) or to another coiling machine (22).

4. A coiling line as in claim 3, **characterised in that** a loop-forming assembly (23) for said rolled stock (12) is disposed between said switching device (17) and each of said coiling machines (21, 22 - 121, 122).

5. A coiling line as in claim 3, **characterised in that** a spiral distributor (25) is disposed in front of each of said coiling machines (21, 22 - 121, 122).

6. A coiling line as in claim 1, wherein each of said mandrels (31) has a horizontal rotational axis, **characterised in that** each of said coil-handling assembly (40) comprises a trolley (41) horizontally movable and supporting a supporting frame (43).

7. A coiling line as in claim 6, **characterised in that** said supporting frame (43) is pivotally mounted on said trolley (41) and comprises a fork-type device (46) suitable to remove the corresponding coil from said mandrel (31) and to support said coil during a rotation of 90° to move said coil from the horizontal forming position on said mandrel (31), to the transport position on said coil-transport means (50), with a vertical axis.

8. A coiling line as in claim 1, **characterised in that** a tying and strapping station (53) for the coils is disposed downstream of each of the coiling machines (21, 22).

9. A coiling line as in claim 1 or 2, **characterised in that** lifting means (56) are disposed downstream of each of the coiling machines (21, 22 - 121, 122) to lift and weigh said coils.

10. A coiling line as in claim 1 or 2, **characterised in that** a tying and strapping station (53) for said coils is provided downstream of said coil-handling assembly (40), and **in that** lifting means (56) are pro-

vided downstream of said tying and strapping station (53) to lift and weigh said coils.

11. A coiling line as in claim 1 or 2, **characterised in that** said selection means comprise a rotary support (117) on which said coiling machines (21, 22) are mounted, and **in that** rotation means (61) are provided to rotate said rotary support (117) and selectively take one of said coiling machines (21) in correspondence with a spiral distributor device (25) and at the same time another of said coiling machines (22) in correspondence with a coil-handling assembly (40) for removing the coil of rolled stock from the corresponding coiling machine.

12. A coiling line as in claim 11, **characterised in that** said first and second coiling machine (21, 22) are mounted on diametrically opposite sides of a rotary support (117).

13. A coiling line as in claim 11, **characterised in that** synchronisation means are provided to synchronise the rotation of said rotary support (117) with the coiling step of the rolled stock (12) on the corresponding coiling machine (21, 22).

14. A coiling line as in claim 1, **characterised in that** each of said coiling machines (21, 22) is mounted on a rotary element (70) able to be selectively displaced between a first working position, wherein the corresponding mandrel (31) is disposed in correspondence with a spiral distributor device (25) and a second working position, and wherein said mandrel (31) is disposed in correspondence with a coil-handling assembly (40) suitable to remove the coil of rolled stock from said mandrel (31).

Patentansprüche

1. Eine Wickelanlage, angeordnet stromabwärts einer Walzstrasse (11) ausgestattet mit Schermitteln (16), welche dazu geeignet sind das Walzgut (12) zu schneiden, welches von der Walzstraße (11) kommt, umfassend eine erste Wickelmaschine (21), welche einen drehbaren Aufspanndorn (31) aufweist, welcher verbunden ist mit korrespondierenden Antriebsmitteln (33), für das Aufwickeln des Walzgutes (12), zur Realisierung eines korrespondierenden, ersten Wickels, wenigstens eine zweite Wickelmaschine (22), welche einen zweiten drehbaren Aufspanndom (31) aufweist, welcher verbunden ist mit einem korrespondierenden Antriebsmittel (33), für das Aufwickeln des Walzgutes (12), um einen korrespondierenden, zweiten Wickel zu realisieren, Auswahlmittel (17, 117), angeordnet stromabwärts besagter Schermittel (16), um das Walzgut (12) alternativ gegen besagte, erste oder besagte, wenigstens zweite Wickelmaschine (21, 22) umzulenken, **gekennzeichnet darin, dass** Mittel zur Verfügung gestellt sind, für die Aktivierung besagter Antriebsmittel (33), eines zu einer Zeit, während alle anderen Antriebsmittel (33) in gestoppten Zustand verbleiben, und darin, dass jede von besagten Wickelmaschinen (21, 22) beinhalten, eine korrespondierende Wickelrollen-Handhabungsvorrichtung (40), welche mit dem Aufspanndorn (31) verbunden ist, um axial den gerade fertiggestellten Wickel von dem Aufspanndorn (31) zu entnehmen, während das damit verbundene Antriebsmittel (33) in seinem stillstehenden Zustand beibehalten wird, um die Transferierung von besagtem Wickel zu einer Transportvorrichtung für die Wickel (50) durchzuführen, welche stromabwärts von besagter Wikkelrollen-Handhabungsvorrichtung angeordnet ist.

2. Eine Wickelanlage, wie beansprucht in Anspruch 1, **gekennzeichnet darin, dass** besagte Auswählmittel (17, 117) dazu geeignet sind das Walzgut (12) umzulenken, um dieses selektiv auf eine dritte und vierte Wickelmaschine (121) und (122) aufzuwikkeln, wobei jede von ihnen dazu geeignet ist das Walzgut (12) aufzuwickeln, um einen korrespondierenden, dritten und vierten Wickel zu realisieren.

3. Eine Wickelmaschine, wie beansprucht in Anspruch 1 oder 2, gekennzeichnet darin, dass besagte Wickelmaschinen (21, 22) in festen Positionen in Bezug zu besagen Schermitteln (16) angeordnet sind, und dass besagte Auswählmittel eine Stellvorrichtung (17) aufweisen, angeordnet stromabwärts von besagten Schermitteln (16), zur selektiven Umlenkung des Walzgutes (12), entweder auf besagte erste Wickelmaschine (21) oder auf eine andere Wickelmaschine (22).

4. Eine Wickelanlage, wie beansprucht in Anspruch 3, **gekennzeichnet darin, dass** eine Schleifen-Formvorrichtung (23) für besagtes Walzgut (12) angeordnet ist, zwischen besagter Stellevorrichtung (17) und jeder der besagten Wickelmaschinen (21, 22 - 121, 122).

5. Eine Wickelanlage, wie beansprucht in Anspruch 3, **gekennzeichnet darin, dass** ein Spiralverteiler (25) angeordnet ist, vor jeder der besagten Wickelmaschinen (21, 22 - 121, 122).

6. Eine Wickelanlage, wie beansprucht in Anspruch 1, worin jeder von besagten Aufspanndornen (31) eine horizontale Rotationsachse aufweist, **gekennzeichnet darin, dass** jede der besagten Wickelrollen-Handhabungsvorrichtungen (40) einen Wagen (41) aufweist, welcher horizontal beweglich ist und einen Stützrahmen (43) stützt.

7. Eine Wickelanlage, wie beansprucht in Anspruch 6, **gekennzeichnet darin, dass** besagter Stützrahmen (43) drehbar montiert ist, auf besagtem Wagen (41), und eine gabelartige Vorrichtung (46) aufweist, welche dazu geeignet ist die korrespondierenden Wickel von besagtem Aufspanndorn (31) abzunehmen und besagten Wickel während dessen Drehung um 90° zu stützen, so dass besagter Wickel aus der horizontalen Herstellungsposition, auf besagtem Aufspanndorn (31), in die Transportposition von besagter Transportvorrichtung für Wikkel (50) bewegt wird, welche eine vertikale Achse aufweist.

8. Eine Wickelanlage, wie beansprucht in Anspruch 1, **gekennzeichnet darin, dass** eine Erfassungs- und Festhaltestation (53) für die Wickel stromabwärts von jeder Wickelmaschine (21, 22) angeordnet ist.

9. Eine Wickelanlage, wie beansprucht in Anspruch 1 oder 2, **gekennzeichnet darin, dass** Hebemittel (56) stromabwärts von jeder der Wickelmaschinen (21, 22 - 121, 122) angeordnet sind, um besagte Wickel zu heben und zu wiegen.

10. Eine Wickelanlage, wie beansprucht in Anspruch 1 oder 2, **gekennzeichnet darin, dass** eine Erfassungs- und Festhaltestation (53) für besagte Wickel stromabwärts von besagter Wickelrollen-Handhabungsvorrichtung (40) zur Verfügung gestellt sind, und darin, dass Hebemittel (56) stromabwärts von besagter Erfassungs- und Festhaltestation (53) zur Verfügung gestellt sind, um besagte Wickel zu heben und zu wiegen.

11. Eine Wickelanlage, wie beansprucht in Anspruch 1 oder 2, **gekennzeichnet darin, dass** besagte Auswählmittel eine drehbare Stütze (117) aufweisen, auf welcher besagte Wickelmaschinen (21, 22) montiert sind, und darin, dass Antriebsmittel (61) zur Verfügung gestellt sind, um besagte drehbare Stütze (117) zu drehen, und selektiv eine von besagten Wickelmaschinen (21) in Korrespondenz mit einer Spiralverteilungsvorrichtung (25) zu nehmen, und zur selben Zeit eine weitere von besagten Wikkelmaschinen (22) in Korrespondenz mit einer Wikkelrollen-Handhabungsvorrichtung (40) für die Abnahme des Wickels des Walzgutes von der korrespondierenden Wickelmaschine zu bringen.

12. Eine Wickelanlage, wie beansprucht in Anspruch 11, **gekennzeichnet darin, dass** besagte erste und zweite Wickelmaschinen (21, 22) an diametral gegenüberliegenden Seiten einer drehbaren Stütze (117) montiert sind.

13. Eine Wickelanlage, wie beansprucht in Anspruch 11, **gekennzeichnet darin, dass** Synchronisationsmittel zur Verfügung gestellt sind, zur Synchronisierung der Drehung von besagter, drehbarer Stütze (117), mit den Wickelschritten des Walzgutes (12), an der korrespondierenden Wickelmaschine (21, 22).

14. Eine Wickelanlage, wie beansprucht in Anspruch 1, **gekennzeichnet darin, dass** jede der besagten Wickelmaschinen (21, 22) montiert ist, auf einem drehbaren Element (70), welches dazu geeignet ist, selektiv versetzt zu werden, zwischen einer ersten Arbeitsposition, in welcher der korrespondierende Aufspanndorn (31) in Korrespondenz mit einer Spiralverteilungsvorrichtung (25) angeordnet ist, und einer zweiten Arbeitsposition, und wobei besagter Aufspanndorn (31) angeordnet ist in Korrespondenz mit einer Wickelrollen-Handhabungsvorrichtung (40), welche dazu geeignet ist den Wickel des Walzgutes von besagten Aufspanndorn (31) abzunehmen.

Revendications

1. Ligne de bobinage située en aval d'un train de laminoirs (11) pourvue de cisailles (16) adaptées pour cisailler le produit de laminage (12) provenant du train de laminoirs (11), comprenant une première machine de bobinage (21) comportant un premier mandrin rotatif (31) relié à des moyens d'entraînement (33) correspondants pour enrouler le produit de laminage (12) afin de réaliser une première bobine correspondante, au moins une deuxième machine de bobinage (22) comportant un deuxième mandrin rotatif (31) relié à des moyens d'entraînement (33) correspondants pour enrouler le produit de laminage (12) afin de réaliser une deuxième bobine correspondante, des moyens de sélection (17, 117) disposés en aval desdites cisailles (16) afin de dévier le produit de laminage (12) alternativement vers ladite première ou ladite au moins deuxième machine de bobinage (21, 22), **caractérisée en ce que** des moyens sont prévus pour actionner lesdits moyens d'entraînement (33), un à la fois, tandis que tous les autres moyens d'entraînement (33) sont maintenus à l'arrêt, et **en ce que** chacune desdites machines de bobinage (21, 22) comprend un ensemble de manipulation de bobine (40) correspondant associé au mandrin (31) pour retirer axialement la bobine déjà achevée du mandrin (31) tandis que les moyens d'entraînement (33) reliés à celuici sont maintenus à l'arrêt et pour transférer ladite bobine vers des moyens de transport de bobine (50) disposés en aval dudit ensemble de manipulation de bobine (40).

2. Ligne de bobinage selon la revendication 1, **caractérisée en ce que** lesdits moyens de sélection (17,

117) sont capables de dévier le produit de laminage (12) à enrouler sélectivement sur une troisième et une quatrième machines de bobinage (121, 122), chacune d'elles étant capable d'enrouler le produit de laminage (12) afin de réaliser une troisième et une quatrième bobines correspondantes.

3. Ligne de bobinage selon la revendication 1 ou 2, **caractérisée en ce que** lesdites machines de bobinage (21, 22) sont disposées dans des positions fixes par rapport auxdites cisailles (16) et **en ce que** lesdits moyens de sélection comprennent un dispositif de commutation (17) agencé en aval desdites cisailles (16) afin de dévier sélectivement le produit de laminage (12) soit vers ladite première machine de bobinage (21) soit vers une autre machine de bobinage (22).

4. Ligne de bobinage selon la revendication 3, **caractérisée en ce qu'**un ensemble de formation de boucles (23) pour ledit produit de laminage (12) est disposé entre ledit dispositif de commutation (17) et chacune desdites machines de bobinage (21, 22 - 121, 122).

5. Ligne de bobinage selon la revendication 3, **caractérisée en ce qu'**un dispositif de distribution de spires (25) est disposé devant chacune desdites machines de bobinage (21, 22 - 121, 122).

6. Ligne de bobinage selon la revendication 1, dans laquelle chacun desdits mandrins (31) a un axe de rotation horizontal, **caractérisée en ce que** chacun desdits ensembles de manipulation de bobine (40) comprend un chariot (41) mobile horizontalement et supportant une structure support (43).

7. Ligne de bobinage selon la revendication 6, **caractérisée en ce que** ladite structure de support (43) est montée de manière pivotante sur ledit chariot (41) et comprend un dispositif du type à fourches (46) adapté pour retirer la bobine correspondante dudit mandrin (31) et pour supporter ladite bobine pendant une rotation de 90° afin de déplacer ladite bobine de la position de formation horizontale sur ledit mandrin (31) dans la position de transport sur lesdits moyens de transport de bobine (50), avec un axe vertical.

8. Ligne de bobinage selon la revendication 1, **caractérisée en ce qu'**un poste de liage et de cerclage (53) pour les bobines est disposé en aval de chacune des machines de bobinage (21, 22).

9. Ligne de bobinage selon la revendication 1 ou 2, **caractérisée en ce que** des moyens de levage (56) sont disposés en aval de chacune des machines de bobinage (21, 22 - 121, 122) pour lever et peser lesdites bobines.

10. Ligne de bobinage selon la revendication 1 ou 2, **caractérisée en ce qu'**un poste de liage et de cerclage (53) pour lesdites bobines est prévu en aval dudit ensemble de manipulation de bobine (40), et **en ce que** des moyens de levage (56) sont prévus en aval dudit poste de liage et de cerclage (53) pour lever et peser lesdites bobines.

11. Ligne de bobinage selon la revendication 1 ou 2, **caractérisée en ce que** lesdits moyens de sélection comprennent un support rotatif (117) sur lequel lesdites machines de bobinage (21, 22) sont montées, et **en ce que** des moyens de rotation (61) sont prévus pour faire tourner ledit support rotatif (117) et mettre sélectivement une desdites machines de bobinage (21) en correspondance avec un dispositif de distribution de spires (25) et en même temps une autre desdites machines de bobinage (22) en correspondance avec un ensemble de manipulation de bobine (40) pour retirer la bobine de produit de laminage de la machine de bobinage correspondante.

12. Ligne de bobinage selon la revendication 11, **caractérisée en ce que** lesdites première et deuxième machines de bobinage (21, 22) sont montées sur des côtés diamétralement opposés d'un support rotatif (117).

13. Ligne de bobinage selon la revendication 11, **caractérisée en ce que** des moyens de synchronisation sont prévus pour synchroniser la rotation dudit support rotatif (117) avec l'étape de bobinage de produit de laminage (12) sur la machine de bobinage (21, 22) correspondante.

14. Ligne de bobinage selon la revendication 1, **caractérisée en ce que** chacune desdites machines de bobinage (21, 22) est montée sur un élément rotatif (70) capable d'être déplacé sélectivement entre une première position de travail, dans laquelle le mandrin (31) correspondant est disposé en correspondance avec un dispositif de distribution de spires (25), et une deuxième position de travail, et dans laquelle ledit mandrin (31) est disposé en correspondance avec un ensemble de manipulation de bobine (40) adapté pour retirer la bobine de produit de laminage dudit mandrin (31).

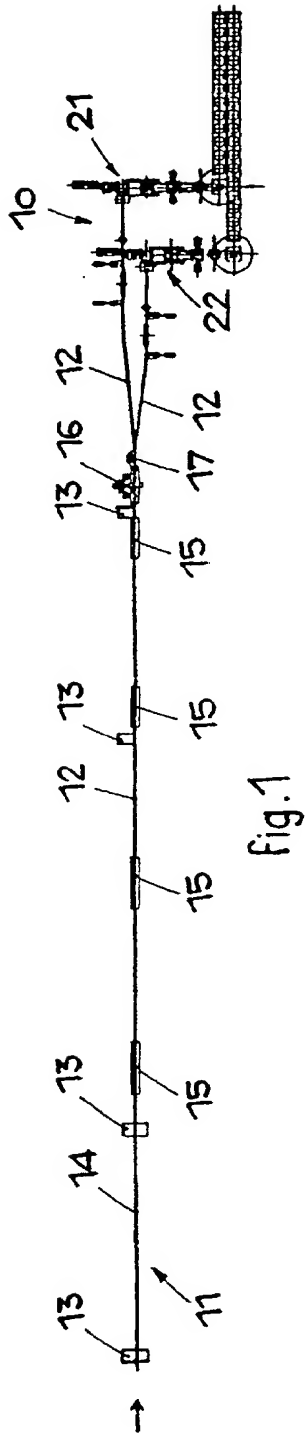
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Fig.1

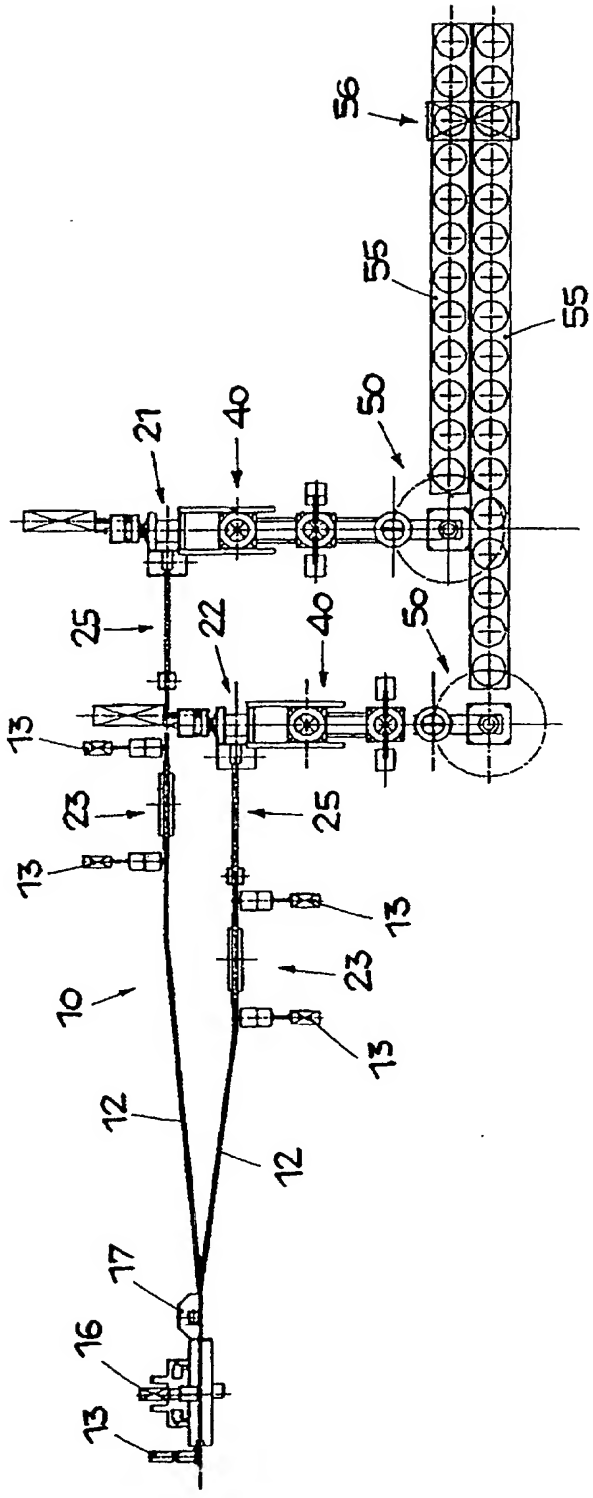
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Fig.2

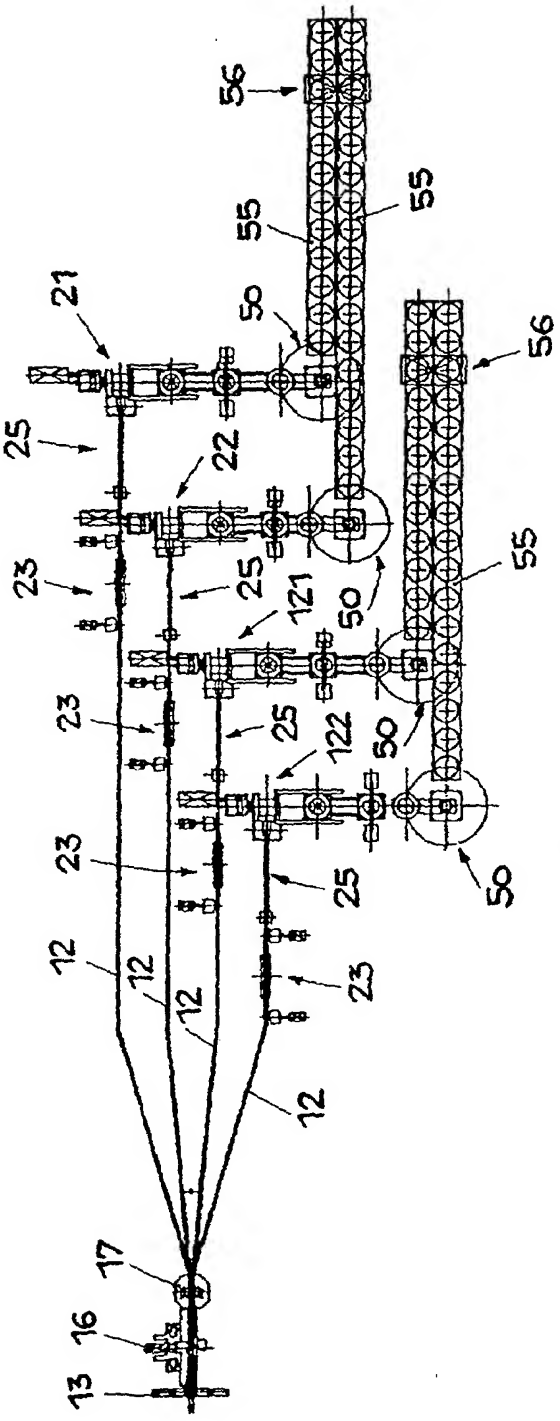
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Fig.3

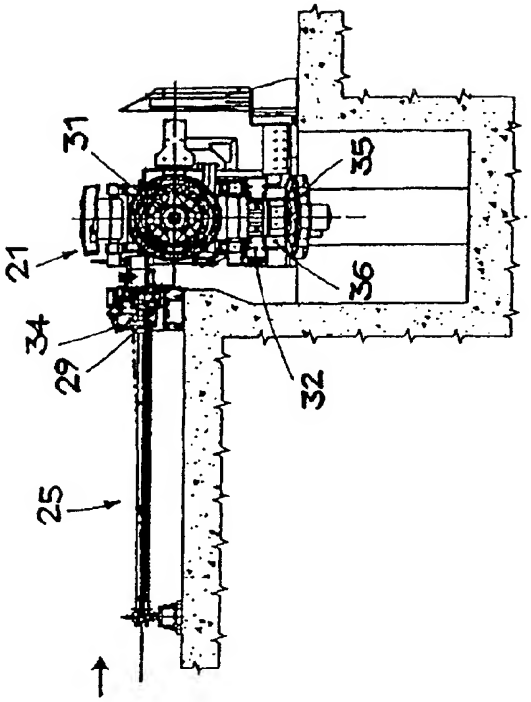
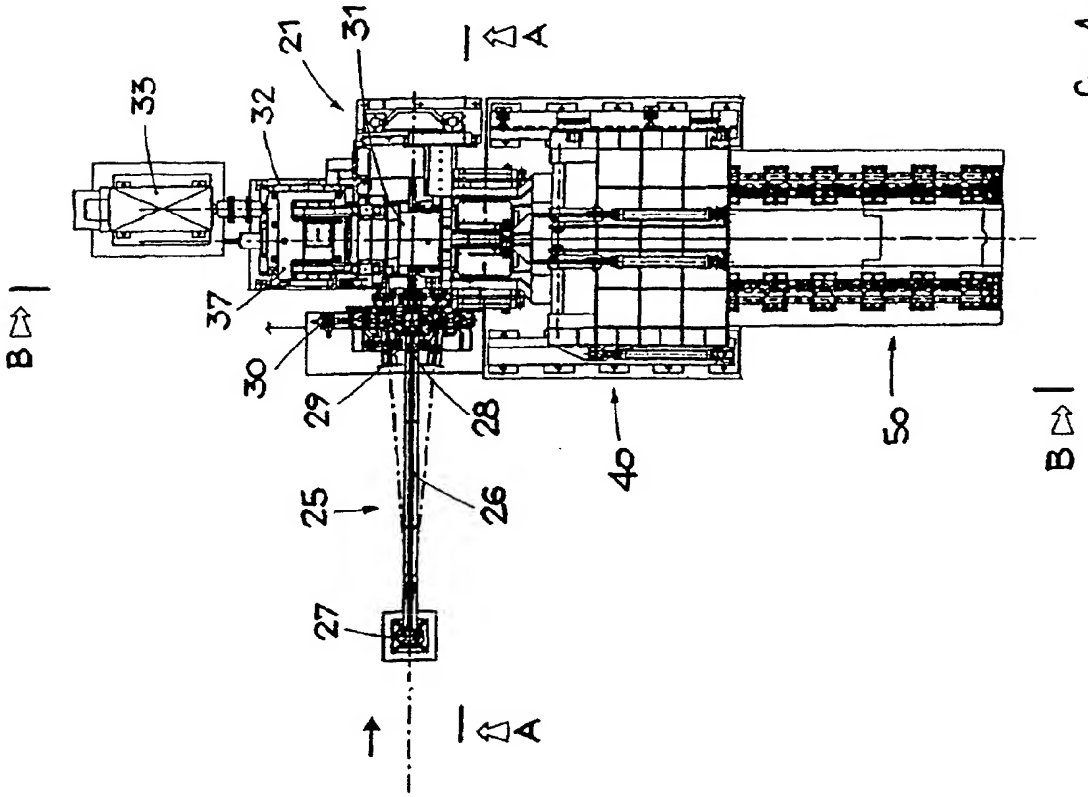


Fig.5



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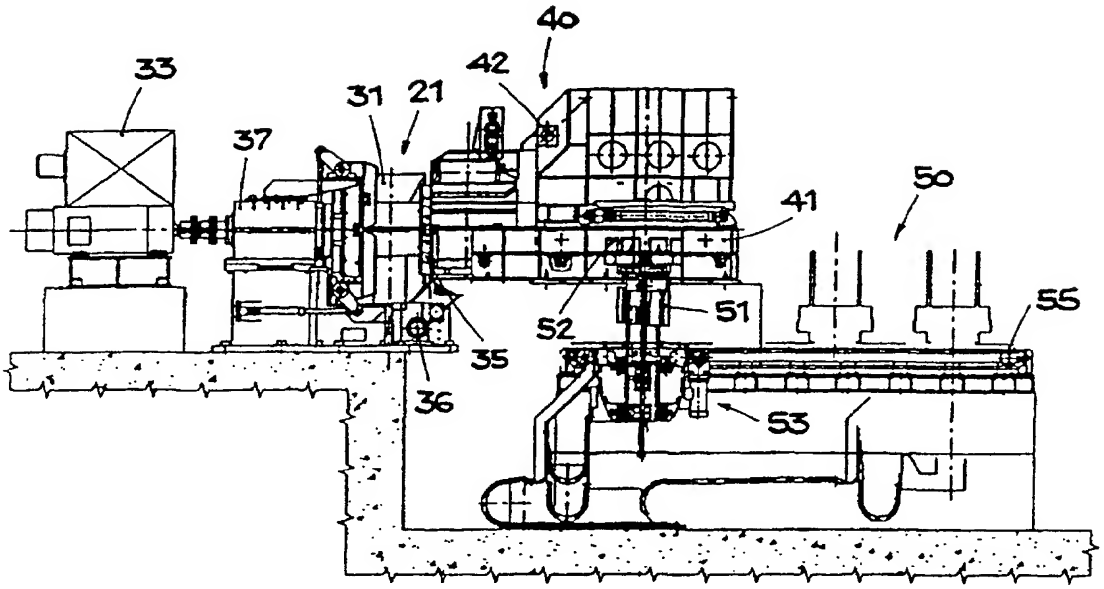
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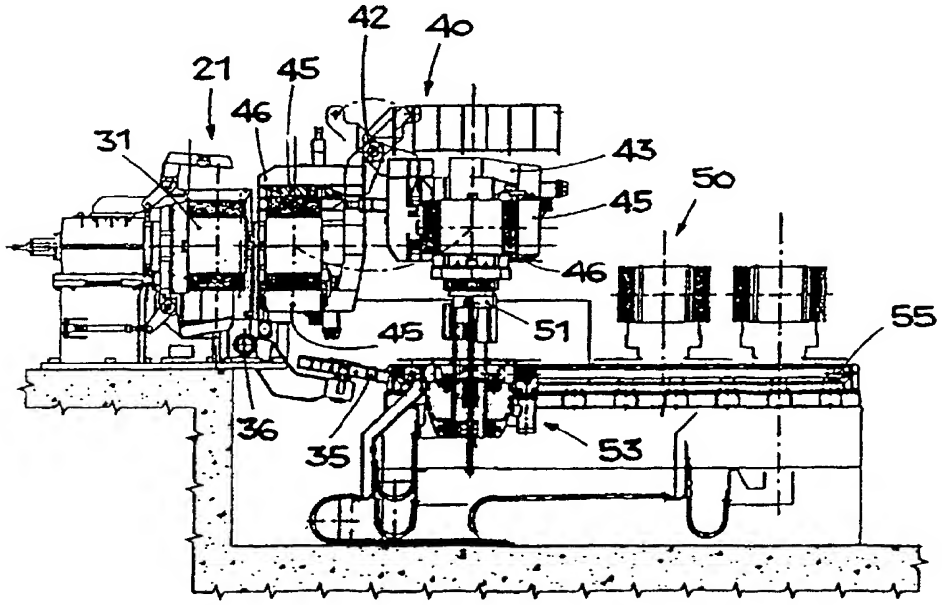
fig.6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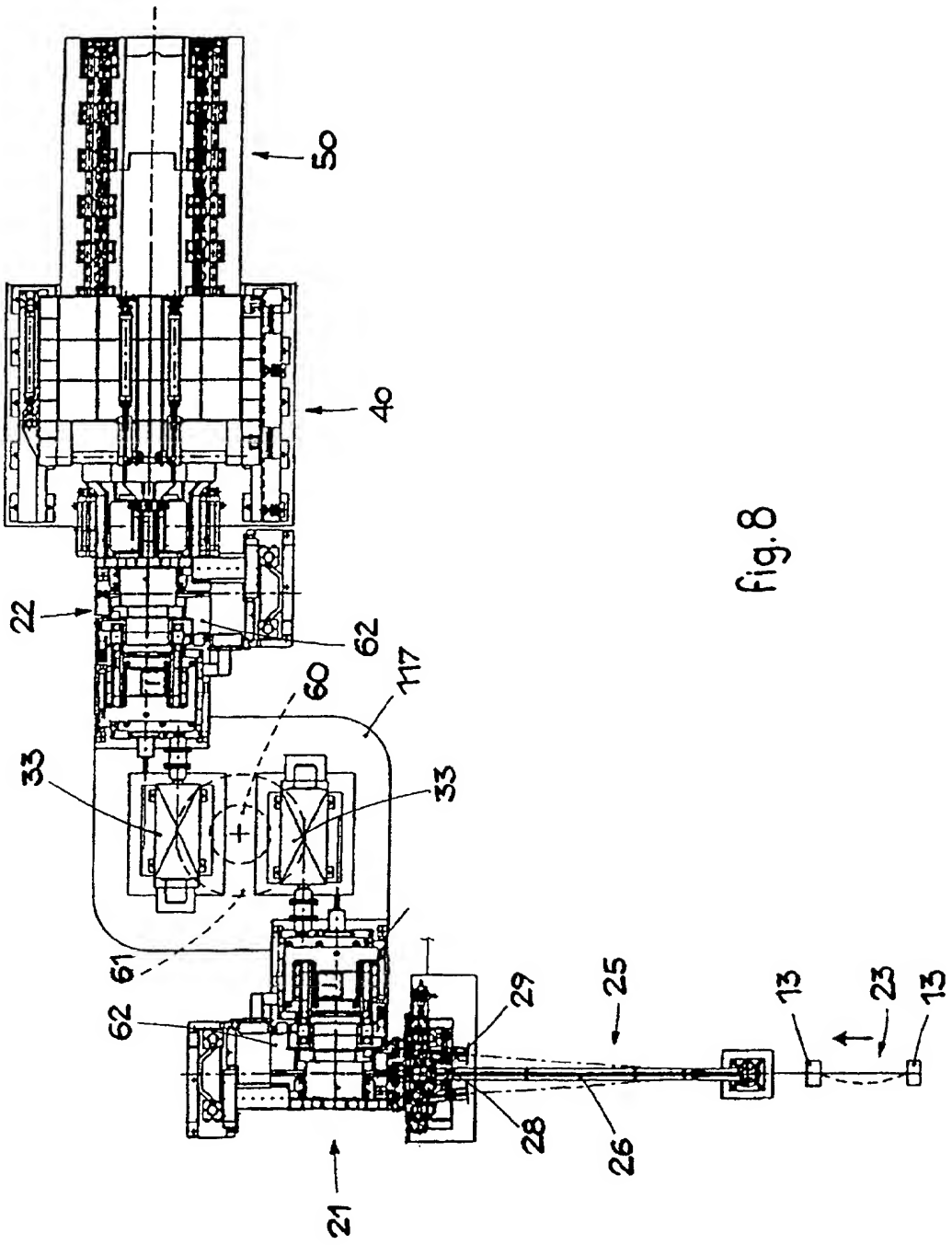

Fig.8

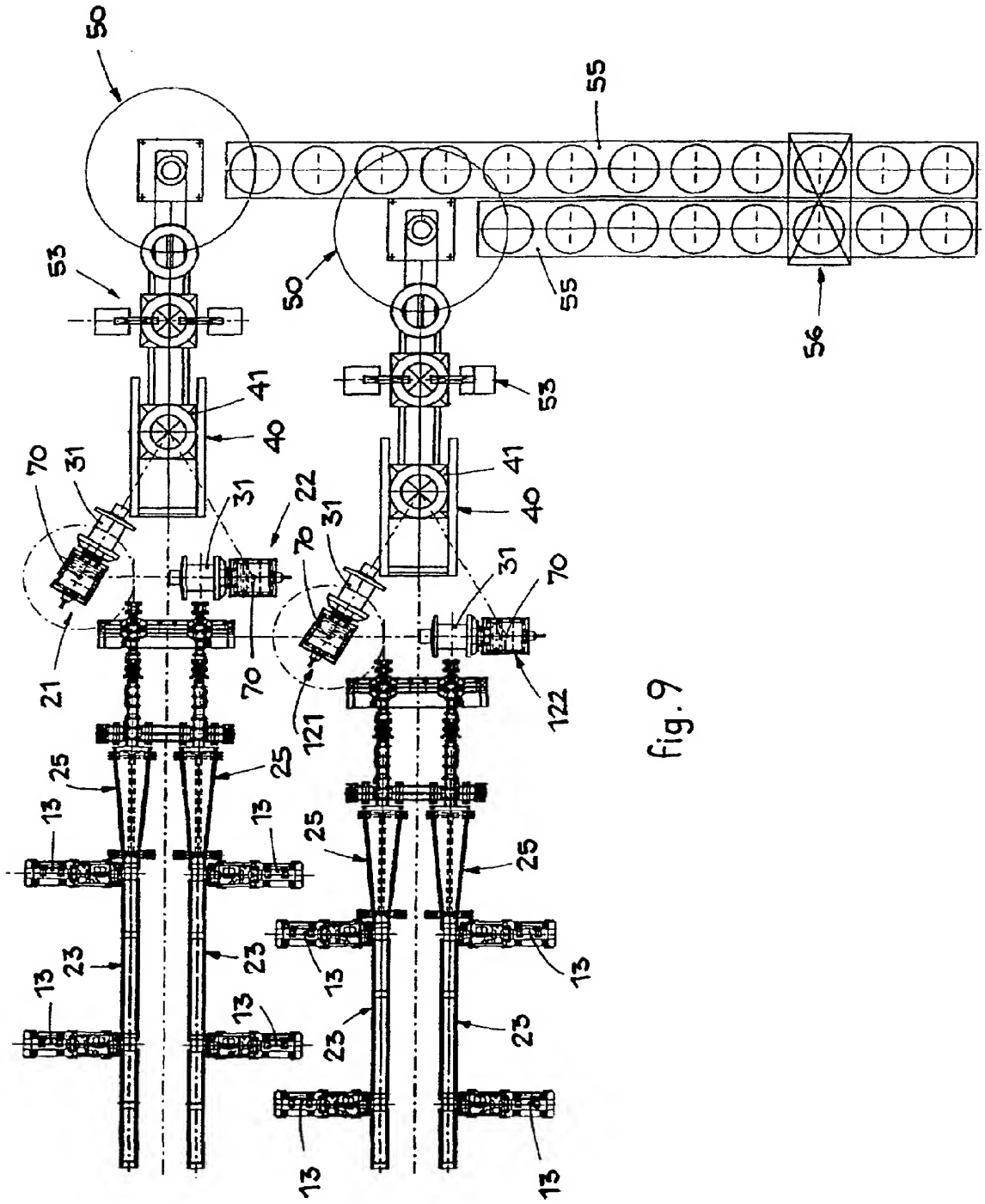
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fig. 9

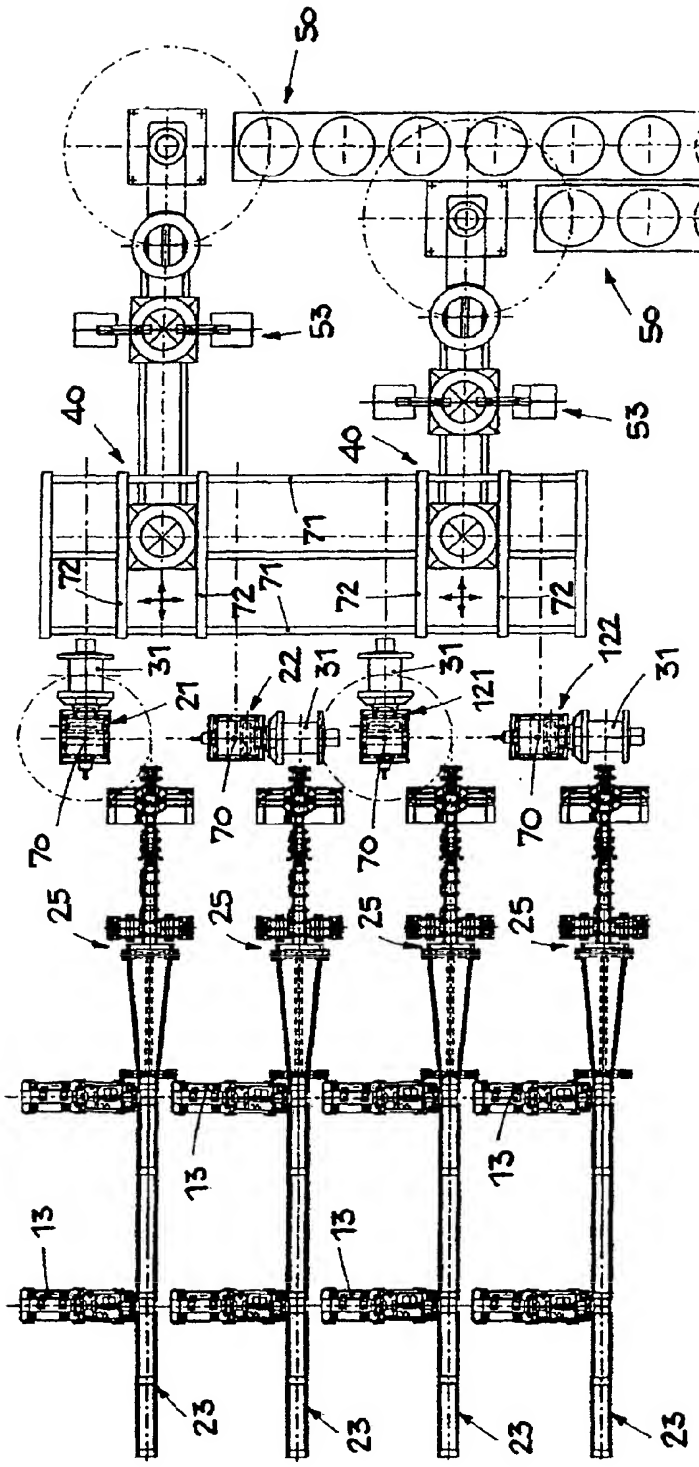
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fig. 10